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PATENT SPECIFICATION

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436,185

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Complete Specification Accepted: Oct. 7, 1935.

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COMPLETE SPECIFICATION

Apparatus for Measuring the Hardness of Metals

I, FELIX EUGENE, 3, rue Georges Bizet à Colombes (Seine) France, of French Nationality, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to apparatus for measuring the hardness of metals and having optical amplification which allows precise observation of the crushing of the metal during the tests under the pressure exercised e.g. by a ball or a diamond.

Apparatus for measuring the hardness of metals are known wherein a variable load lever acts on a vertically movable member carrying the indentor member (ball, needle, diamond or the like), the displacement of said member controlling the inclination of a mirror which reflects a pencil of light on to a measuring screen.

According to the present invention and with the object of obtaining a much greater sensitiveness, the movable member carrying the indentor member acts upon a system of levers which, after mechanically amplifying the movement of said member, controls the inclination of a pivotted reflecting member which reflects a pencil of light on to a measuring scale.

Apparatus for measuring the hardness of metals are also known comprising a load lever upon which the load can be moved in order to regulate the force applied to the indentor member.

In further accordance with the present invention, the load lever is provided, in addition to a main load hooked to its end, with a movable load member which can be slid along said lever. As said load member is only a part of the total load, the fineness of adjustment is increased.

The invention will be generally better understood with the help of the description which follows with reference to the annexed drawings, which show, by way of example only, the embodiment of an apparatus for measuring the hardness of metals.

Fig. 1 shows in vertical section the apparatus for measuring the hardness of metals.

Fig. 2 shows an end view of the apparatus with a part detached.

Figs. 3 and 4 are horizontal sections on the lines 3—3, 4—4, of fig. 1.

According to the invention, the apparatus comprises a frame, supporting on the one hand, the specimen-carrying arrangement and, on the other hand, the loading apparatus.

The extent of the indentation formed under a determined load in the body subjected to the test can be rapidly read by means of an optical measuring system disposed in this frame.

On the base 1 of a frame 2 there is fixed the specimen-carrying arrangement which comprises a hollow column 3 which is slidable in a split ring 4 which forms a clamp and is disposed in a recess 5 provided in the base 1. The parts forming the clamp are drawn together by means of a screw, provided with a collar 7 which is operable from outside the frame by a handle 8.

On the upper part of the column 3, a bore 9 accommodates a collar 10 which can be adjusted angularly but not longitudinally, on account of a groove 11 provided in the body of the collar 10 and in which end of a screw 12 engages. A handle 13, fixed in the head of the collar, permits angular adjustment of the same in the bore.

The inside of said collar is screwed to receive a member 14a, in the lower part of which is provided a groove 15 in the form of a straight vertical slot receiving the end of a screw 16, also positioned in the column 3. This member can, therefore, be displaced vertically in the column when the collar 10 is adjusted angularly in its seating. A collar 17 is provided on the upper part of the member and has a spherical seating in which rests the ball 18 of a specimen-carrying table 19. This ball is retained in position by a screwed ring 20 which screws on to the collar 17.

The upper part of the casing 2 is provided at its upper part with a swan neck 2a in, and upon which, is fixed the loading arrangement and the measuring system.

Openings are provided in the axis of

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the hollow column in which are placed the collars 21, 22 having ball bearings 23, 24 which can be regulated by rings 25, 26 which screw into the said collars and are fixed by screws 27, 28.

The collar 21 is fixed by four screws and the collar 22 is screwed into the swan neck 2a, the latter collar being retained in correct position by a nut 29. The collar 21 is provided with two bearings 30 in which are provided the ball bearings 31 of the pivots 32 of the loading arrangement. This arrangement comprises a graduated beam 33, balanced by a regulatable counterweight 34. Loading weights 35, each, for example, giving an effective load of 5 kilogrammes, can be placed on a plate 36 suspended by its hook 37 from an eye 38 fixed on the end of the beam 33. A load member 39 capable of sliding on the scale of the beam 33 allows all load settings between zero and 8 kilogrammes to be obtained. A blunt point 40, fixed on the underpart of the beam and engaging at the axis of the column 3, transmits the loads on to a carrying and indenting member 41. The latter is mounted in the ball bearings 23, 24 which guide it vertically.

When not in action, the load beam can be raised so that the blunt point 40 no longer presses on the indentor-carrying member 41. This raising or stopping of the lever is obtained by means of a screw 42 screwed into the swan neck 2a by means of a nut 43 carrying an operating handle 44; this nut is fixed in position after adjustment by a lock-nut 44a.

The collar 22 is also provided with two ears 45, on one of which is fixed a stop 46a in the form of a pin which can be introduced into a notch provided in the indenting carrying member in order to avoid any angular displacement of the member in the ball bearings 23, 24.

Between the two ears 45 there is disposed a lever 46, of light metal or of a metal alloy of high resistance, which can oscillate on the pivots 47 which are maintained in spaced relationship from the indenting carrying member by two ball bearings lodged in journals carried by the ears 45.

A ground and polished finger 48, of tempered steel, is fixed in the end of the lever 46; this finger is constantly in contact with a pin 49, also of polished steel, fixed in a mortice 50 provided in the indentor-carrying member 41, perpendicular to the finger 48.

At the extremity of the lever opposite to the finger 48 there is disposed an axis 51 comprising a screw and a small tempered steel collar upon which is supported a finger carried by the optical system. This system consists of a support 52, pivotted about an axis 53 fixed in the casing 2. This support which forms a cap carries a foot 54 in which is provided a slot 55 which permits regulation of a screw 56. This foot 54 is constantly urged away by a spring 57 and regulation of the position of the cap 52 is obtained by means of a nut 58 provided with a handle 59. Between the two flanges of the cap 52 there is pivotted a support of L-shape 60 by means of screwed pivots 61 (fig. 3). On one part of this support 60 a mirror 62 is fixed such that its horizontal axis coincides exactly with the axis joining the points of the screw pivots 61, and on the other part a finger 63 resting on the collar of the axis 51 in order to ensure connection between the lever 46 and the optical system.

The optical amplification is governed by the distance between the axis of oscillation of the support 60 carrying the mirror 62, and the axis of the collar 51. This distance can be exactly regulated by displacing the support 60 with reference to the cap 52, by means of a screw 64 which is then locked by screws.

The position of the mirror with reference to the pivots 47 can be regulated by the nut 58 acting on the foot 54 of the cap 52 through the screw 56.

The spot projected on to the mirror is reflected by the same on to a transparent screen 65, fixed in an opening provided in the swan neck 2a and carrying graduations 66. All vertical displacement of the ball-carrier acts on the mirror and the luminous spot through the intermediary of the lever 46 and the two finger 51, 63.

The source of light is constituted by an electric lamp of small voltage which is disposed in the objective holder 67 which contains a condenser, a reticule and a lens. The objective carrier is adjustable in all directions in order that the axis of the beam will strike the axis of the mirror exactly. This adjustment is obtained by a double joint 68, serving as a support to the objective holder, and fixed on an axis 69 solid with the casing 2. The measuring apparatus is set to zero at the commencement of a test by means of a conical cap 70, which is screwed on to the collar 22 and locked in position, after adjustment, by a threaded ring 71.

In order to test a specimen of metal the height of the table 19 on which the specimen rests is first adjusted, then the apparatus is set to zero by bringing the specimen into contact with the point of the diamond or the ball which is raised until the specimen touches the cap 70 which is preliminarily adjusted and which serves as a basis of reference; then the

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necessary loading masses 35 are placed on the plate 36 and then the load lever is freed by screwing the screw 42 into the casing. At this instant the blunt point 40 commences to act upon the indentor-carrying member 41 and upon the finger 48 of the lever 46 through the intermediary of the axis 49. The lever 46 causes the mirror 62 to oscillate more or less which projects the light spot formed by the optical system on to the graduations 66 on the transparent screen 65.

The depth of the indentation is then accurately measured after unloading, it being necessary to remove the load in order to get a reading of the permanent indentation, apart from the indentation due to the elasticity of the material.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. Apparatus for measuring the hardness of metals by static penetration comprising an indentor-carrying member subjected to a variable load and an optical amplifying and indicating system, the apparatus being characterised in that the indentor-carrying member acts on a system of levers which mechanically amplifies the displacements of said member and transmits them to the pivotted reflecting member of the optical system.

2. Apparatus for measuring the hardness of metals, according to claim 1, characterised in that the indentor-carrying member acts on the smaller arm of an amplifying lever pivotted about a fixed pivot and whose greater arm actuates, through a contact member at its end, a finger integral with the pivotted reflecting member of the optical system.

3. Apparatus for measuring the hardness of metals according to claim 2, characterised in that the position of the pivotted reflecting member of the optical system is adjustable with reference to the amplifying lever.

4. Apparatus for measuring the hardness of metals according to claim 1, characterised in that it is provided with a member such as a sleeve, cap or the like which can be regulated as to height and which can be firmly fixed to the fixed frame of the apparatus, said sleeve permitting of the apparatus being set immediately to zero, before a test, by applying the surface of the piece to be tested against the lower edge of said cap, sleeve or the like.

5. Apparatus for measuring the hardness of metals according to claim 1, characterised in that it comprises a specimen-carrier which is universally supported by means of a ball joint supported by a sleeve which can be regulated as to height.

6. Apparatus for measuring the hardness of metals according to claim 1, with a load lever provided with a regulatable counterweight and a main load applied at the end, characterised in that it is also provided with a load member which can be slid along the said lever.

7. Apparatus for measuring the hardness of metals substantially as hereinbefore described with reference to the accompanying drawing.

Dated this 12th day of January, 1935.
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and
49, Chancery Lane, London.

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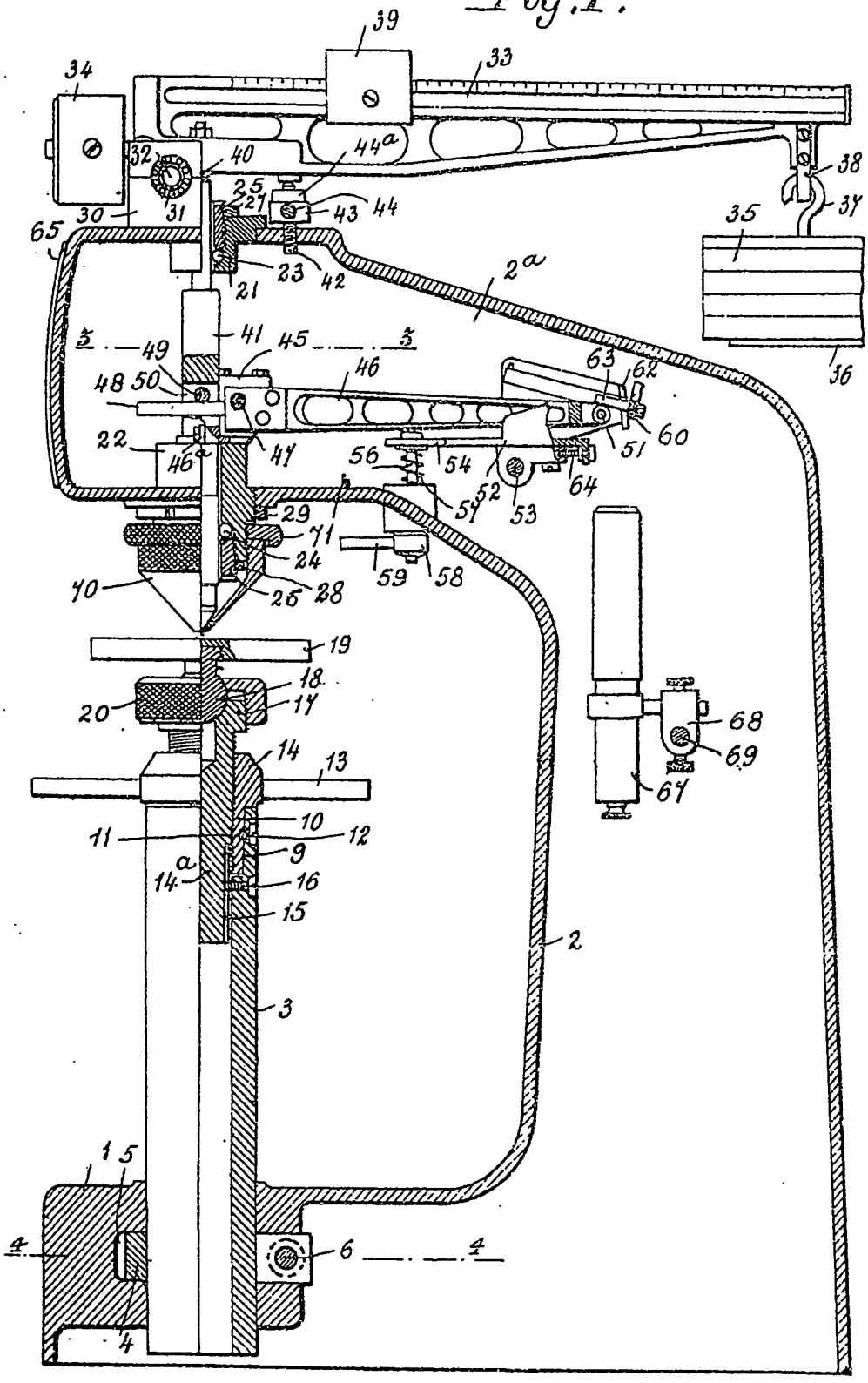
Fig. 1.



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SHEET 1

Fig. 2.

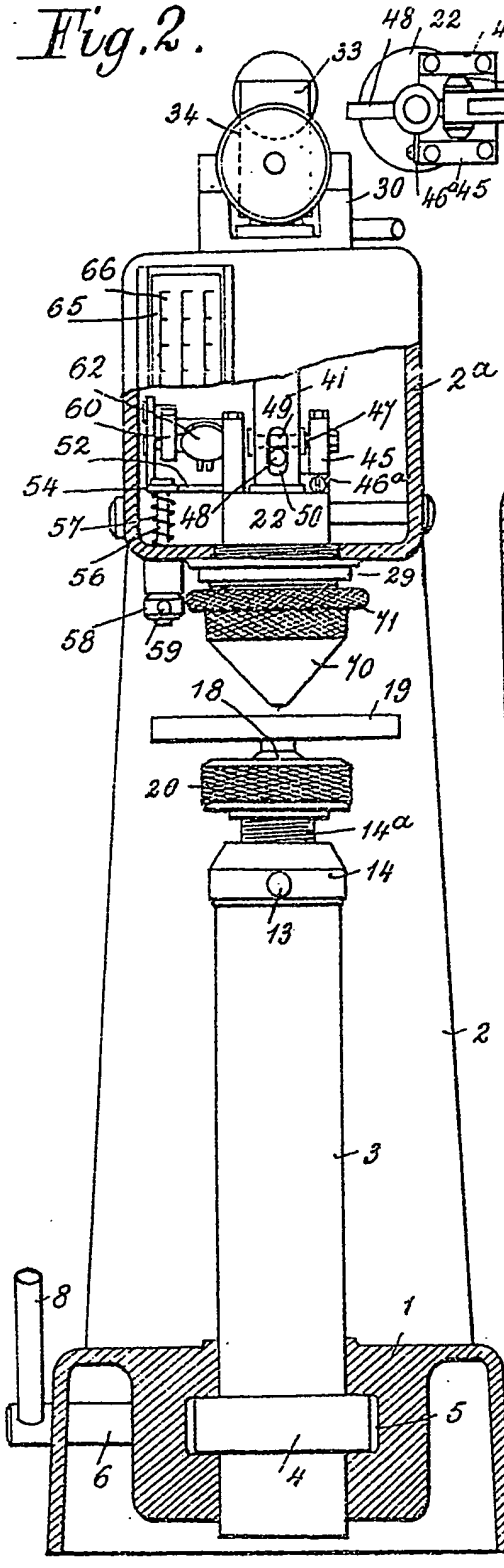
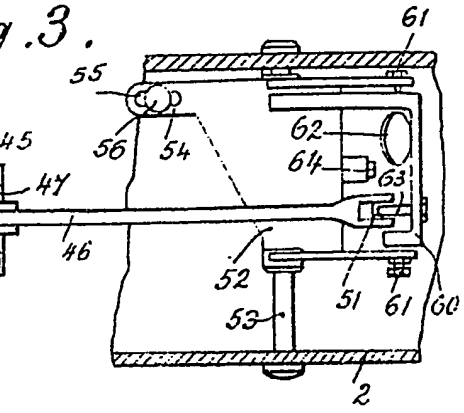


Fig. 3.



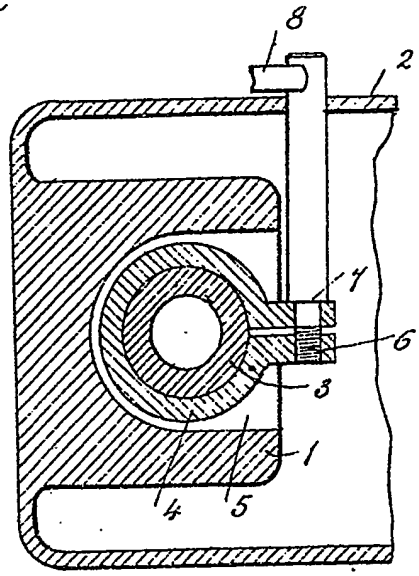


Fig. 4.

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SHEET 1

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

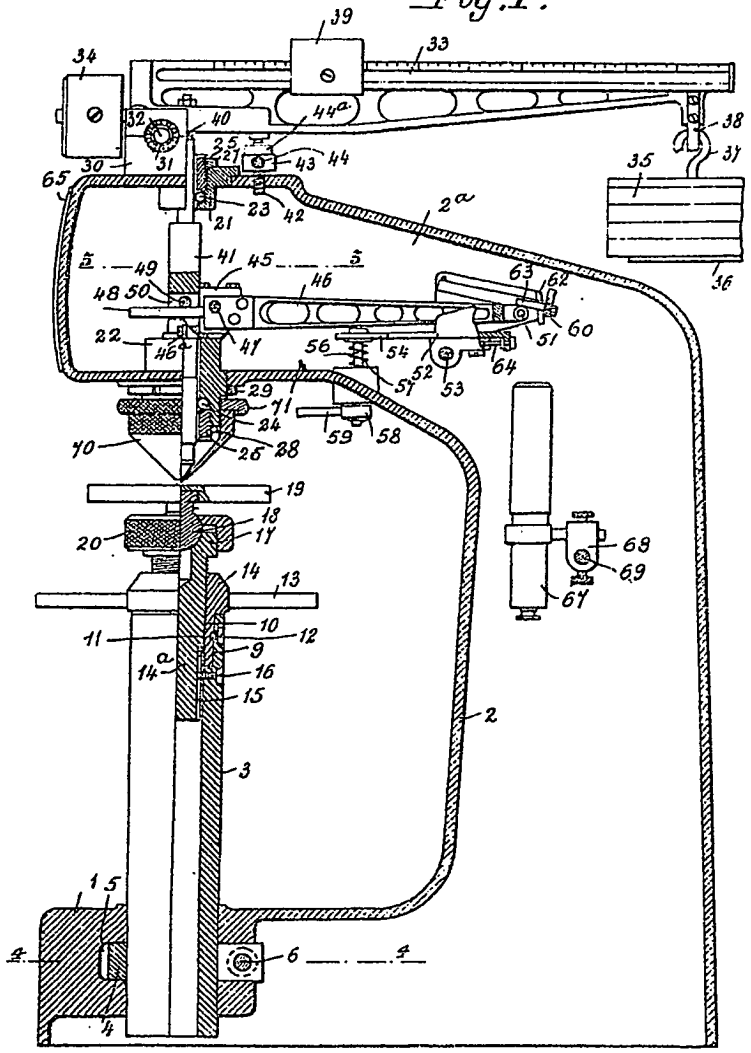


Fig. 2.

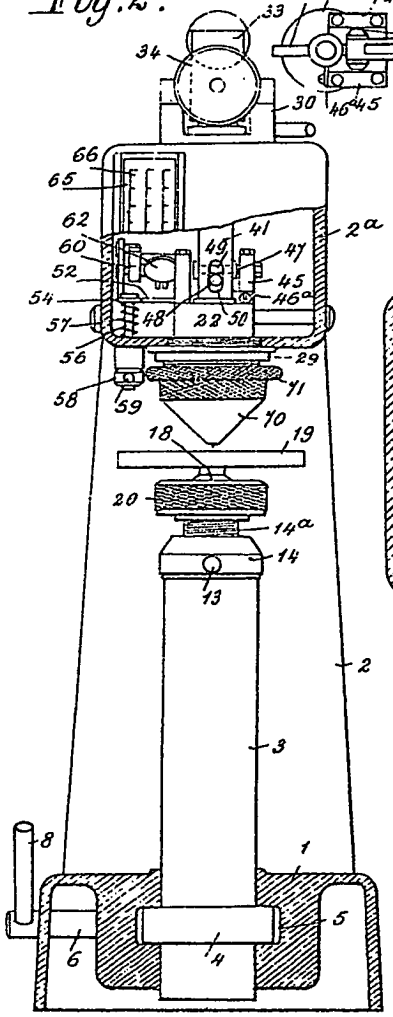


Fig. 3.

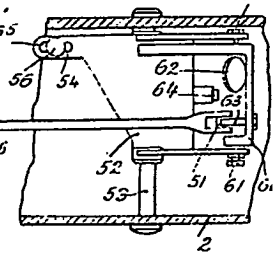
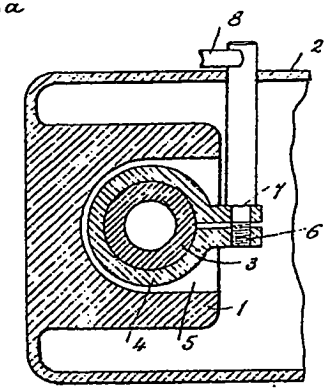


Fig. 4.



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